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ACANTHOCEPHALANS OF THE GENUS *CENTRORHYNCHUS* (PALAEACANTHOCEPHALA, CENTRORHYNCHYDAE) FROM BIRDS OF UKRAINE WITH THE DESCRIPTION OF A NEW SPECIES

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Acanthocephalans of the Genus *Centrorhynchus* (Palaeacanthocephala, Centrorhynchydae) from Birds of Ukraine with the Description of a New Species. Lisitsyna, O. I., Greben, O. B. — The article presents the results of the investigation of material on the genus *Centrorhynchus* Lühe, 1911 stored in the collection of the Department of Parasitology, Schmalhauzen Institute of Zoology, National Academy of Sciences of Ukraine. Five species: *Centrorhynchus aluconis*, *C. globocaudatus*, *C. spinosus*, *C. conspectus* and *C. polissiensis* sp. n. were studied and described. *Centrorhynchus polissiensis* sp. n., differs from all known species by the complex morphological characters, in particular, by the formula of proboscis hooks in combination with the number of large hooks with roots, by the number of hooks in anterior part of the proboscis, and by comparatively smaller eggs. *C. polissiensis* sp. n. is most similar to *C. aluconis*, *C. conspectus* and *C. globocaudatus*. The main differences between the species are in the proboscis armament, 13–17 hooks in a longitudinal row in *C. aluconis*, 16–18 hooks in *C. conspectus* vs 19–20 hooks in *C. polissiensis* sp. n., and in the egg sizes, 56–65 × 28–30 for *C. aluconis*, 68–72 × 33–35 for *C. conspectus* vs 45–55 × 25 for *C. polissiensis* sp. n. *C. polissiensis* sp. n. differs from *C. globocaudatus* in shape and morphology of the proboscis hooks. We do not confirm the record of *C. amphibius* from birds of the territory of Ukraine. The data on synonymy, hosts and distribution in Ukraine and in the world are given for seven species of the genus recorded in Ukraine. Illustrated descriptions about the material of collection are presented for five species. We provide an identification key for nine species of the genus *Centrorhynchus* of the birds of the fauna of Ukraine and adjacent territories.

Key words: Acanthocephala, *Centrorhynchus*, *Centrorhynchus polissiensis* sp. n., Strigiformes, Falconiformes, Ukraine.

Акантоцефалы рода *Centrorhynchus* (Palaeacanthocephala, Centrorhynchidae) от птиц Украины с описанием нового вида. Лисицына О. И., Гребень О. Б. — В статье представлены результаты обработки коллекционных материалов акантоцефалов рода *Centrorhynchus* Lühe, 1911, хранящихся в отделе паразитологии Института зоологии НАН Украины. Отмечено 5 видов — *C. aluconis*, *C. globocaudatus*, *C. spinosus, C. conspectus* и описываемый в данной статье новый вид, *Centrorhynchus polissiensis* sp. n. Новый вид отличается от всех известных видов рода комплексом морфологических признаков, в частности: формулой крючьев хоботка в сочетании с количеством крупных крючьев с корнями; количеством крючьев, располагающихся в передней части хоботка; размером крючьев; относительно мелкими яйцами. *C. polissiensis* sp. n. наиболее близок к *C. aluconis*, *C. conspectus* и *C. globocaudatus*. Основные отличия между видами в вооружении хоботка: в продольном ряду *C. aluconis* 13–17, у *C. conspectus* 16–18 крючьев против 19–20 у *C. polissiensis* sp. n. и в размерах яиц: 56–65 × 28–30 у *C. aluconis*, 68–72 × 33–35 у *C. conspectus* против 45–55 × 25 у *C. polissiensis* sp. n. *C. polissiensis* sp. n. отличается от *C. globocaudatus* формой хоботка и морфологией крючьев. Не подтверждена находка на территории Украины *C. amphibius*. Для семи видов, известных на территории Украины, приведены данные о синонимике, хозяевах, распространении в Украине и мире; для пяти видов рода — описания и рисунки по материалам коллекции. Составлена таблица для определения 9 видов рода *Centrorhynchus* от птиц фауны Украины и сопредельных территорий.

Ключевые слова: акантоцефалы, *Centrorhynchus*, *Centrorhynchus polissiensis* sp. n., Strigiformes, Falconiformes, Украина.

Introduction

Acanthocephalans of the genus *Centrorhynchus* Lühe, 1911 are known mainly from the birds of prey, owls and rarely from birds of other groups. So far, 7 species were recorded in the birds of Ukraine: *C. aluconis* (Müller, 1780) Lühe, 1911; *C. amphibius* Das, 1950, *C. buteonis* (Schrank, 1788) Kostylew, 1914, *C. conspectus* Van Cleave et Pratt, 1940, *C. globocaudatus* (Zeder, 1800) Lühe, 1911, C. *magnus* Fukui, 1922, *C. spinosus* (Kaiser, 1893) Van Cleave, 1924 (Ivanitzky, 1940; Smogorzhevskaya, 1954, 1976; Zhukov, 1956; Gritsenko, 1969; Lisitsyna, 1993, 2008, 2014; Kornyushin et al., 2004). Information about hosts, localities and the time of the finding of these parasites is reported in most of the mentioned papers without the descriptions and figures about the material of the collection. The special studies on the acanthocephalans of the genus *Centrorhynchus* of the fauna of Ukraine were not carried out early.

Regular helminthological studies of the birds of Ukraine have been carried out in the Department of Parasitology of Schmalhausen Institute of Zoology NAS of Ukraine since the late 50s of the XX century. Helminthological studies of predatory birds and owls happen infrequently, mostly as occasional dissections during the hunting seasons. Nevertheless, the existing collection of these parasites includes the records from 10 bird species from 8 regions of Ukraine. Partially collection was processed by the researchers of the Department of Parasitology and some others departments of Ukraine, the results were published in a series of faunistic studies (Smogorzhevskaya, 1954, 1976; Gritsenko, 1969; Lisitsyna, 1993, 2008; Kornyushin et al., 2004). The aim of the present work was the revision of the collection of the genus *Centrorhynchus*, the description of the found species, and the analysis of the information from literature about the species of the genus parasitizing in birds of Ukraine and adjacent territories.

Material and methods

The present research was based on a study of acanthocephalans of the genus *Centrorhynchus* from the collection of the Department of Parasitology, Schmalhausen Institute of Zoology NAS of Ukraine (SIZK). The collection was compiled by L. A. Smogorzhevska, A. N. Gritsenko, V. V. Kornyushin, N. I. Iskova, as well as the authors of the present study during the years 1950–2010. Material collected from 10 species of birds was investigated (table 1). Live acanthocephalans were relaxed in water and, thereafter, fixed and stored in 70 % ethanol. Morphology of the acanthocephalans was studied on temporary total mounts cleared in Berlese's medium using a compound Zeiss Axio Imager M1 microscope equipped with DIC optics. Drawings were made with the aid of a drawing tube. All measurements in the text and table are in micrometers unless otherwise stated. Trunk length does not include proboscis, neck, or bursa. The hosts of acanthocephalans from the collection of Schmalhausen Institute of Zoology NAS of Ukraine are marked by sign 1. The data on the hosts according the leterature are marked by sign 2.

Centrorhynchus aluconis (Muller, 1780) Lühe, 1911 (fig. 1, A–E)

Syn. *Echinorhynchus aluconis* Müller, 1780; *E. otidis* Schrank, 1788; *E. inequalis* Rudolphi, 1808; *E. appendiculatus* Westrumb, 1821; *E. soricis* Rudolphi, 1819; *Centrorhynchus appendiculatus* Westrumb, 1821; *C. olssoni* Lundström, 1942.

G e n e r a l (8 ♀, 10 ♂). Trunk elongate, almost cylindrical. Proboscis divided into 2 parts by constriction at level of receptacle attachment. Proboscis anterior part spatulate or spherical, proboscis posterior conical. Neck short. Proboscis with 28–34 longitudinal rows of 13–17 (16) hooks. First 3–5 (4) hooks large with posteriorly directed strong roots. Next 3–4 hooks transitional, with roots consisting of 2 antero–lateral alate processes, remaining hooks spiniform with anteriorly directed simple roots. Length of blade increasing from first to third, then gradually decreasing, blade of transitional hooks smallest. Roots increase from first to 4–5th, roots of transitional hooks smallest. Proboscis receptacle double-walled, attached in proboscis middle, forming constriction. Lemnisci sacciform, longer than proboscis receptacle. Gonopore subterminal in both sexes.

M a l e s. Trunk 19.80–35.00 (22.56) mm long with maximum width in testis region 780–1080 (907). Proboscis 760–1020 (866.25) long with maximum width at anterior part 380–440 (402), anterior part of proboscis up to constriction 450–530 (483) long, width at constriction 201–380 (322). Proboscis with 28–32 (29.7) longitudinal rows of 13–17 (15.15) hooks. First 3–5 (4) hooks large with posteriorly directed strong roots. Hook blade length: 1, 31–55 (42.94); 2, 41–60 (52.47), 3, 45–58 (52.82); 4, 32–53 (44.6); 5, 25–40 (33). Hook blade thickness: 1, 7–13 (9.86); 2, 10–18 (14.8); 3, 18–25 (20.2); 4, 10–25 (19.2); 5, 8–13 (10.3). Hook root length: 1, 33–55 (50.73); 2, 53–63 (55.37); 3, 49–68 (63.93); 4, 37–73 (58.4); 5, 25–31 (26.89). Transitional hook blade length 25–40 (34.87), 8–10 (9) thick, hook root 20–25 (23.5) long. Spiniform hook blade length 33–43 (38), hook root processes 20–25 (24.3)

T a b l e 1. Materials of the Acanthocephales collection of the genus *Centrorhynchus*

Т а б л и ц а 1. Материалы коллекции Acanthocephales рода *Centrorhynchus*

Host	Locations	N	Data	Name of species	Number, ♂ ♀	Collector
Nycticorax nycticorax (Linnaeus, 1758)	Kherson Region, Chaplynka District, Sofiyivka	82–22	07.07.1952	*C. spinosus*	1 ♀	L. Smogorzhevska
Plegadis falcinellus Linnaeus, 1766	Odesa Region, Kilia District, Vilkove	466–2	16.06.1968	*C. spinosus*	1 ♀	L. Smogorzhevska
Buteo buteo Linnaeus, 1758	Kyiv Region, Brovarsky District, Zazimye	73–1	08.04.2003	*C. polesiensis*	2 ♂, 2 ♀	O. Greben
				C. spinosus	1 ♀	
Cyrcus cyaneus (Linnaeus, 1766)	Donetsk Region, Striltsivsky step	–	16.06.1963	*C. conspectus*	2 ♂, 1 ♀	V. Sharpilo
Circus aeruginosus (Linnaeus, 1758)	Volyn Region, West Polissya	12 (1)	01.06.1956	*C. spinosus*	3 ♂, 2 ♀	N. Srebrodolska
Falco tinnunculus Linnaeus, 1758	Crimea, Bakhchisaray District, Skalyste	–	09.1956	*C. globocaudatus*	3 ♂, 1 ♀	V. Sharpilo
F. tinnunculus	Chernihiv Region, Semenivsk District, Orlikovske forestry	320–1	21.06.1972	*C. globocaudatus*	1 ♀	V. Kornyushin
F. tinnunculus	Kherson Region, Churyuk peninsula	20	18.04.1983	*C. globocaudatus*	5 ♂, 7 ♀	O. Lisitsyna
F. tinnunculus	Kherson Region, Black Sea Reserve District	6/1	16.08.2010	*C. globocaudatus*	7 ♂, 10 ♀	O. Lisitsyna
				C. spinosus	2 ♂, 1 ♀	
Falco naumanni Linnaeus, 1758	Kherson Region, V. Aleksandrivka	–	14.05.1962	*C. globocaudatus*	2 ♂	V. Sharpilo
F. naumanni	Crimea, Chornomorsk District, Tarhankut	136–1	15.07.1967	*C. globocaudatus*	12 ♂, 3 ♀	L. Smogorzhevska
Bubo bubo (Linnaeus, 1758)	Kyiv Region, Bila Tserkva	403–1	19.12.1972	*C. conspectus*	8 ♂, 10 ♀	V. Kornyushin
B. bubo	Ukraine	155–1	25.12.1972	*C. conspectus*	1 ♂, 3 ♀	V. Kornyushin
Strix aluco Linnaeus, 1758	Volyn Region, Lyubeshyv District, Nevir	639–1	24.07. 1973	*C. aluconis*	1 ♂, 3 ♀	V. Kornyushin
S. aluco	Zakarpattya Region, Rahiv District, Luch	160	13.02.1985	*C. aluconis*	1 ♂	L. Lugova
S. aluco	Zakarpattya Region, Rahiv District	140	01.03.1985	*C. aluconis*	1 ♂	L. Lugova
S. aluco	Zakarpattya Region, Rahiv District, Luch	156	12.03.1985	*C. aluconis*	2 ♀	L. Lugova
S. aluco	Zakarpattya Region, Rahiv District, Lazeschina	216	12.02.1986	*C. aluconis*	1 ♂	L. Lugova
S. aluco	Zakarpattya Region, Rahiv District, V. Bychkov	218	13.02.1986	*C. aluconis*	1 ♀	V. Chumak
S. aluco	Ivano-Frankiv Region, Nadvonyansk District, Losva	4	13.02.1987	*C. aluconis*	4 ♂, 2 ♀	L. Lugova
S. aluco	Zakarpattya Region, Rahiv District	–	03.02.1991	*C. aluconis*	4 ♂, 4 ♀	V. Chumak
S. aluco	Zakarpattya Region, Rahiv District, Luch	6	10.02.1993	*C. aluconis*	2 ♀	B. Godovanec
S. aluco	Zakarpattya Region, Rahiv District, Luch	6	23.02.1993	*C. aluconis*	6 ♂, 4 ♀	B. Godovanec
S. aluco	Kyiv, zoological garden	–	05.03. 2000	*C. aluconis*	2 ♂, 3 ♀	R. Salamatin
Strix uralensis (Pallas, 1771)	Zakarpattya Region, Rahiv District	104	05.02.1985	*C. aluconis*	4 ♂, 1 ♀	L. Lugova
S. uralensis	Zakarpattya Region, Rahiv District, V.Bychkov	213	07.02.1986	*C. aluconis*	2 ♀	L. Lugova
S. uralensis	Zakarpattya Region, Rahiv District, Laginiza	227	21.02.1986	*C. aluconis*	4 ♂, 4 ♀	L. Lugova
S. uralensis	Zakarpattya Region, Rahiv District, Ch. Tysa	228	21.02.1986	*C. aluconis*	2 ♂, 2 ♀	L. Lugova
S. uralensis	Zakarpattya Region, Tyachiv District, Kireshi	229	21.02.1986	*C. aluconis*	3 ♂, 4 ♀	L. Lugova
S. uralensis	Zakarpattya Region, Rahiv District, V. Bychkov	230	21.02.1986	*C. aluconis*	3 ♂, 2 ♀	L. Lugova
S. uralensis	Zakarpattya Region, Rahiv District	14	19.02.1990	*C. aluconis*	1 ♂	V. Chumak
S. uralensis	Zakarpattya Region, Rahiv District	–	12.12.1990	*C. aluconis*	1 ♀ juv.	V. Chumak
S. uralensis	Zakarpattya Region, Rahiv District	–	12.12.1990	*C. aluconis*	2 ♀	V. Chumak

long. Proboscis receptacle 1150–1500 (1328) long, with maximum width 320–410 (376). Neck short, 50–130 (102) long. Lemnisci 1080–2430 (1868) long, sacciform, extend behind proboscis receptacle, but not up anterior testis. Testes in tandem slightly overlapping one another. First testis 925–1310 (1100) × 450–550 (486), second testis 850–1220 (1185) × 380–520 (486). Cement glands 6.2–10.57 (8.94) mm long. Säfftigen pouch 2.23–2.76 (2.50) mm long.

Females. Trunk 32.48–42.00 (35.70) mm long, with maximum width at anterior part 860–1800 (1186). Proboscis 670–900 (716) long with maximum width in anterior part 390–430 (371), anterior part of proboscis up to constriction 400–490 (455) long with wide

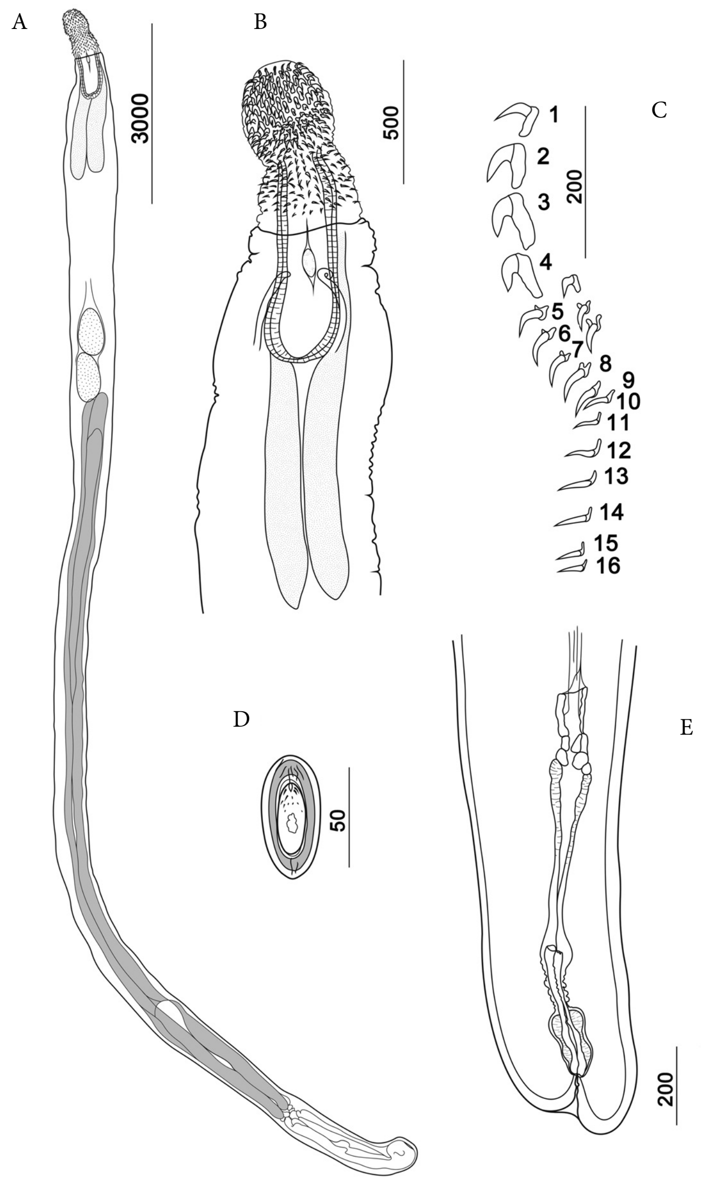


Fig. 1. *Centrorhynchus aluconis* from *Strix aluco*: A — total view, ♂; B — proboscis, ♂; C — hooks of a longitudinal row, ♂; D — egg; E — terminal part of female reproductive system.

Рис. 1. *Centrorhynchus aluconis* от *Strix aluco*: A — общий вид, ♂; B — хоботок, ♂; C — крючья продольного ряда, ♂; D — яйцо; E — терминальная часть половой системы самки.

at constriction 300–370 (337). Proboscis with 30–34 (32.28) longitudinal rows of 15–17 (16) hooks. First 3–5 (4) hooks large with posteriorly directed strong roots. Hook blade length: 1, 40–60 (47.33); 2, 50–58 (53); 3, 50–55 (52.63); 4, 30–54 (47); 5, 28–54 (38). Hook blade thickness: 1, 8–13 (11); 2, 13–18 (15.4); 3, 15–23 (19.9); 4, 20–24 (21.4); 5, 10–18 (11.7). Hook root length: 1, 35–50 (41.83); 2, 50–68 (56.71); 3, 55–70 (65.22); 4, 43–70 (62.66); 5, 25–37 (28). Transitional hook blade length 28–43 (35.16), 8–13 (10.6) thick, hook root 25–28 (26) long. Spiniform hook blade length 33–43 (38.7), hook root processes 20–25 (24.1) long. Proboscis receptacle 1115–1500 (1298) long with maximum width 320–440 (395). Neck short, 40–100 (68.75) long. Lemnisci 2370–2420 (2395) long. Reproductive tract 1.65–2.55 long, consist of vagina with two sphincters, uterus and uterine ball. Eggs elongate-oval, without polar prolongation of fertilization membrane, 56–65 (63.05) × 28–30 (29.66).

Remarks. Proboscis of this species is armed with 30–34 longitudinal rows of hooks, 16–17 hooks in a row according to Petrochenko (1958) and Khokhlova (1986). Among them, the first 5–7 hooks are large, with well-developed roots. In the description of Dimitrova and Gibson (2005) which was based on the material from the Natural History Museum (London) from *Strix aluco* of the United Kingdom, 28–29 longitudinal rows of hooks were indicated, 14–15 hooks in a row, of which the first 4 hooks were large with developed roots. Our material is similar to the specimens described by Dimitrova and Gibson (2005).

The species was described from birds of prey in Europe. It is recorded from birds of the genera *Accipiter*, *Buteo*, *Strix*, *Otus*, *Circus*, *Haliaetus*, *Milvus* in Europe and Asia. It is found in Ukraine in western marsh harrier *Circus aeruginosus*[1], common kestrel *Falco tinnunculus*[1], brown owl *Strix aluco*[2], ural owl *S. uralensis*[2] in Zakarpattya Region (Rahiv District — Luch, Lazeschina, V. Bychkov, Ch. Tysa, Tyachiv District — Kireshi), Ivano-Frankivsk Region (Nadvornyansk District, Losva), Volyn Region (Lyubeshyv District, Nevir), Dnipropetrovsk Region (Pankovka) (Ivanitzky, 1940; Khohlova, 1986; Lisitsyna, 1993, 2008, 2014).

Centrorhynchus buteonis (Schrank, 1788) Kostylew, 1914

Syn. *Echinorhynchus buteonis* Schrank, 1788; E. caudatus Zeder, 1803; *E. polyacanthoides* Creplin, 1825; *Centrorhynchus polyacanthus* (Schrank, 1788) Kostylew, 1914; *C. wedli* (Sonsino, 1896) Ports, 1909; *Centrosoma buteonis* in Porta, 1910.

Description (by Meyer, 1933). Female 35–47 mm long (or rare 68), male 22–35 mm long. Proboscis almost cylindrical, rounded in apex. Hooks by Marval (1905) in 30–32 longitudinal rows of 7–10 hooks and 5–6 spines in each row. Eggs 52–60 × 18–20.

The species was described from the birds of prey in Europe. It is recorded from birds of the genera *Buteo*, *Strix*, *Falco*, *Circus*, *Haliaetus*, *Milvus* in Europe, Asia and Australia. It is found in Ukraine in european honey buzzard *Pernis apivorus*[1], pallid harrier *Circus macrourus*[1], common kestrel *Falco tinnunculus*[1] in Dnipropetrovsk Region (Pankovka) (Ivanitzky, 1940; Khohlova, 1986; Lisitsyna, 1993, 2008, 2014).

Centrorhynchus conspectus Van Cleave et Pratt, 1940 (fig. 2, A–D)

Syn. *C. wardae* Holloway, 1958.

General (2 ♂, 4 ♀). Trunk elongate, almost cylindrical. Proboscis divided into 2 parts by constriction at level of receptacle attachment. Anterior proboscis part spatulate or spherical, posterior proboscis part conical. Neck short. Proboscis with 30–32 longitudinal rows of 16–18 (17) hooks. First 4–6 (5) hooks large with posteriorly directed strong roots. Next 3–4 hooks transitional, with roots consisting of 2 antero–lateral alate processes, remaining hooks spiniform with simple roots directed anteriorly. Length of blade increasing

[1] Data of literature.

[2] Material of the collection.

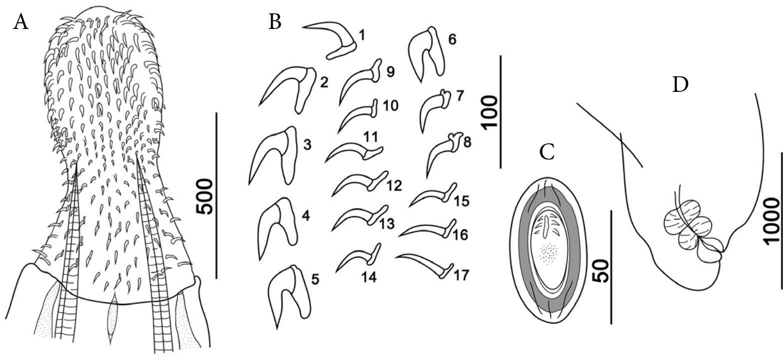


Fig. 2. *Centrorhynchus conspectus* from *Bubo bubo*: A — proboscis, ♂; B — hooks of a longitudinal row, ♂; C — egg; D — terminal part of female reproductive system.

Рис. 2. *Centrorhynchus conspectus* от *Bubo bubo*: A — хоботок, ♂; B — крючья продольного ряда, ♂; C — яйцо; D— терминальная часть половой системы самки.

from first to third, then gradually decreasing, blade of transitional hooks smallest. Roots increasing from first to 4–5th, roots of transitional hooks smallest. Proboscis receptacle double-walled, attach in middle proboscis, formed constriction. Lemnisci sacciform, longer than proboscis receptacle. Gonopore subterminal in both sexes.

Males. Trunk 16.00–23.10 mm long, with maximum width in testis region 970–1100. Proboscis 800–880 long with maximum width in anterior part 400, anterior part of proboscis up to constriction 470 long with width at constriction 360–380. Proboscis with 30–31 longitudinal rows of 16–17 hooks. First 4–6 (5) hooks large with strong roots directed posteriorly. Hook blade length: 1, 40–50; 2, 50–55; 3, 60–63; 4, 50–53. Hook blade thickness: 1, 7–12; 2, 10–18; 3, 18–25; 4, 10–25; 5, 10–18. Hook root length: 1, 35–38; 2, 40; 3, 43–45; 4, 45–65; 5, 50; 6, 35–50. Transitional hook blade length 33–40, 8–10 thick, hook root 38–40 long. Spiniform hook blade length 33–38, hook root processes 20–25 long. Proboscis receptacle 1310–1580 long with maximum width 350–400. Neck short, 40–110 long. Lemnisci extended behind proboscis receptacle, but not up anterior testis. Lemnisci 1690–2980 long. Testes in tandem slightly overlapping one another at a distance 430–680 from bottom of proboscis receptacle. First testis 890–1020 × 500–600, second testis 93–95 × 500–600. Cement glands 9.47 mm long. Säfftigen pouch 2.23 mm long.

Females. Trunk 28.00–30.00 mm long, with maximum width in anterior part 1100–1400. Proboscis 800–1000 long with maximum width in anterior part 400–430, anterior part of proboscis up to constriction 470–550 long with width at constriction 350–380. Proboscis with 30–32 longitudinal rows of 16–18 hooks. First 4–5 (4.6) hooks large with strong roots directed posteriorly. Hook blade length: 1, 53; 2, 55–65; 3, 50–64; 4, 48–58; 5, 33–55. Hook blade thickness: 1, 12–13; 2, 15–18; 3, 18–22; 4, 20–25; 5, 15–23. Hook root length: 1, 30–43; 2, 50–55; 3, 50–60; 4, 60–70; 5, 33–58. Transitional hook blade length 38–43, 12–13 thick, hook root 20–28 long. Spiniform hook blade length 33–43, hook root processes 20–25 long. Proboscis receptacle 1200–1600 long with maximum width 340–400. Neck short, 40–90 long. Lemnisci 1350–1420 long. Reproductive tract 2300–2550 long, consist of vagina with two sphincters, uterus and uterine ball. Eggs elongate-oval, without polar prolongation of fertilization membrane, 68–72 × 33–35.

R e m a r k s. The species was described from barred owl *Strix varia* Barton, 1799 in North America (Van Cleave, Pratt, 1940). Our material corresponds to the first description (Van Cleave et Pratt, 1940).

It is recorded from the birds of the genera *Strix*, *Aquila*, *Otus*, *Athene*, *Asio* in the Volga region and Asia (Turkmenistan, Tajikistan). It is found in Ukraine in hen harrier *Circus cyaneus*[2], eagle-owl *Bubo bubo*[2] in Donetsk Region (Strilzovska Step Reserve) (Lisitsyna, 1993).

Centrorhynchus globocaudatus (Zeder, 1800) Lühe, 1911 (fig. 3, A–E)

Syn. *Echinorhynchus globocaudatus* Zeder, 1800; *E. tuba* Rudolphi, 1802, in part.

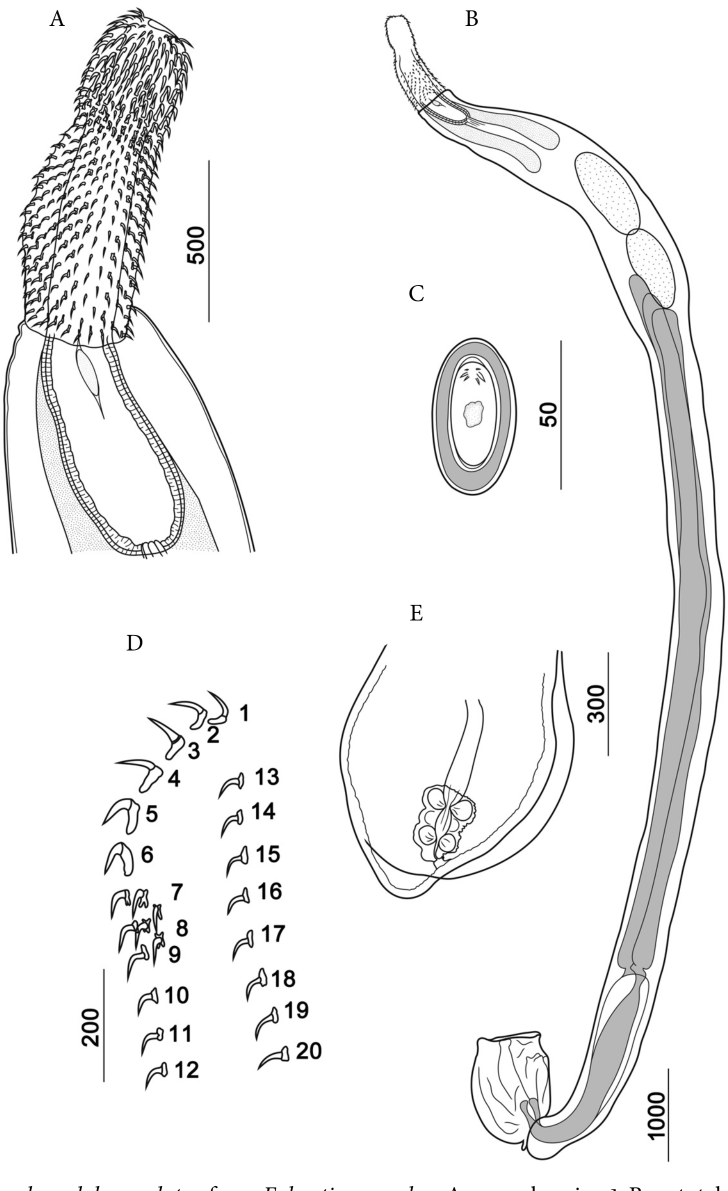


Fig. 3. *Centrorhynchus globocaudatus* from *Falco tinnunculus*: A — proboscis, ♂; B — total view, ♂; C — egg; D — hooks of a longitudinal row, ♂; E — terminal part of female reproductive system.

Рис. 3. *Centrorhynchus globocaudatus* от *Falco tinnunculus*: A — хоботок, ♂; B — общий вид, ♂; C — яйцо; D — крючья продольного ряда, ♂; E — терминальная часть половой системы самки.

Global (7 ♂, 14 ♀). Trunk elongate, almost cylindrical. Proboscis rounded apical, then almost conical. Constrictions implicit. Neck short. Proboscis with 30–34 longitudinal rows of 19–21 hooks. First 5–6 hooks large with posteriorly directed strong roots. Next 3–5 hooks transitional, with composite scutiform «X»-shaped root processes. Next 5–7 hooks spiniform with simple scutiform root processes, last 3–7 hooks spiniform with simple roots directed anteriorly. Length of blade increasing from first to third, then gradually decrease. Hook root length increasing from first to 5–6th then gradually decreasing. Proboscis receptacle double-walled, attach in middle proboscis. Lemnisci sacciform, longer than proboscis receptacle. Gonopore subterminal in both sexes.

Males. Trunk 11.95–18.80 (15.56) mm long, with maximum width in testis region 760–1080 (930). Proboscis 920–1130 (1050) long with maximum width in anterior part 300–354 (320), anterior part of proboscis up to level of attachment of proboscis receptacle 430–500 (450) long with width at attachment 280–330 (300). Proboscis with 30–34 (31.1) longitudinal rows of 19–21 (20.1) hooks. First 5–6 (5.6) hooks large with posteriorly directed strong roots. Hook blade length: 1, 40–50 (46.6); 2, 48–63 (54.5); 3, 50–68 (57.6); 4, 45–63 (52.2); 5, 45–55 (50); 6, 40–50 (49.6). Hook blade thickness: 1, 7–10 (8); 2, 10–13 (11); 3, 13; 4, 13; 5, 13–15 (13.8); 6, 13–15 (13.8). Hook root length: l, 30–40 (34.63); 2, 37–60 (46.3); 3, 43–60 (49.5); 4, 43–65 (51.7); 5, 45–63 (51.8); 6, 20–50 (32.5). Transitional hook blade length 38–45 (41), 7–13 (9) thick, hook root 37–45 (41.3) long, hook root processes 15–35 (23) long. Spiniform hook blade length 38–45 (40), hook root processes 17–30 (26) long. Proboscis receptacle 1100–1550 (1260) long with maximum width 230–370 (290). Neck short, 30–50 (40) long. Lemnisci 920–1900 (1500) long, extended to testes, overlie on anterior one. Testes in tandem slightly overlapping one another. First testis 730–1060 (910) × 430–660 (500), second testis 850–1080 (980) × 458–660 (546). Cement glands 7.83–11.08 (8.82) mm long. Säfftigen pouch 1.4–2.65 (2.21) mm long. Bursa invaginated 2000×1300.

Females. Trunk 15.01–40.00 (20.18) mm long, with maximum width in anterior part 800–1400 (1060). Proboscis 920–1180 (1060) long with maximum width in anterior part 300–400 (340), anterior part of proboscis up to level of attachment of proboscis receptacle 450–550 (470) long with width at attachment 280–360 (320). Proboscis with 30–36 (33) longitudinal rows of 19–21 (19.8) hooks. First 5–6 hooks large with posteriorly directed strong roots. Hook blade length: 1, 43–53 (47.7); 2, 53–63 (57.6); 3, 50–65 (60.7); 4, 45–65 (56.2); 5, 43–55 (48.6); 6, 35–50 (47.7). Hook blade thickness: 1, 6–7 (6.7); 2, 10–11 (10.2); 3, 12–13 (12.5); 4, 12–13 (12.7); 5, 12–18 (14.6); 6, 8–15 (11.8). Hook root length: 1, 25–50 (37.5); 2, 38–60 (50); 3, 45–68 (53.2); 4, 45–63 (53.2); 5, 30–63 (51.37); 6, 20–60 (42.3). Transitional hook blade length 38–48 (42.3), 8 thick, hook root 18–43 (26.9) long. Spiniform hook blade length 37–45 (40), hook root processes 20–35 (25) long. Proboscis receptacle 1160–1620 (1300) long with maximum width 250–410 (360). Neck short, 30–50 (40) long. Lemnisci 920–2050 (1660) long. Eggs elongate-oval, without polar prolongation of fertilization membrane, 53–60 (56.1) × 24–30 (28.2).

The species was described from birds of prey in Europe. It is recorded from the birds of the genera *Athene*, *Milvus*, *Buteo*, *Circus*, *Aquila*, *Falco*, *Tyto*, *Anthus* in Europe, Asia and Africa. It is found in Ukraine in black kate *Milvus migrans* (Boddaert, 1783)[1], common kestrel *Falco tinnunculus*[2], lesser kestrel *Falco naumanni*[2] in Chernihiv Region (Orlikivske forestry), Kherson Region (area of Black Sea Reserve, Velyka Oleksandrivka and peninsula Churyuk), Crimea (Tarhankut) (Smogorzhevskaya, 1954, 1976; Gritsenko, 1969; Khohlova, 1986[2]; Lisitsyna, 1993, 2008).

Centrorhynchus magnus Fukui, 1922

Syn. *Centrorhynchus microrchis* Fukui, 1929.

Description (by Fukui, 1929 from Petrochenko, 1958). Trunk cylindrical, anterior third or quarter slightly widened. Female 32–42 mm long, 700–1000 wide; male 20–26 mm

long, 600–800 wide. Proboscis rather long; proboscis anterior part almost cylindrical, in male 680–750 long, 350–400 wide, in female 650–770 long, 350–490 wide; proboscis posterior part conical and the same long as the anterior. Males with 38–40 longitudinal rows in anterior part and 40–42 in posterior part. Female's number rows greater than male's by two. Each longitudinal row with 26–27 hooks, 15–17 large and with roots, 9–11 without roots. Female's proboscis receptacle 550–1650 long. Limnisci cylindrical, almost twice longer than proboscis receptacle (1000–3000); extended to anterior testis. Testes ellipsoidal,

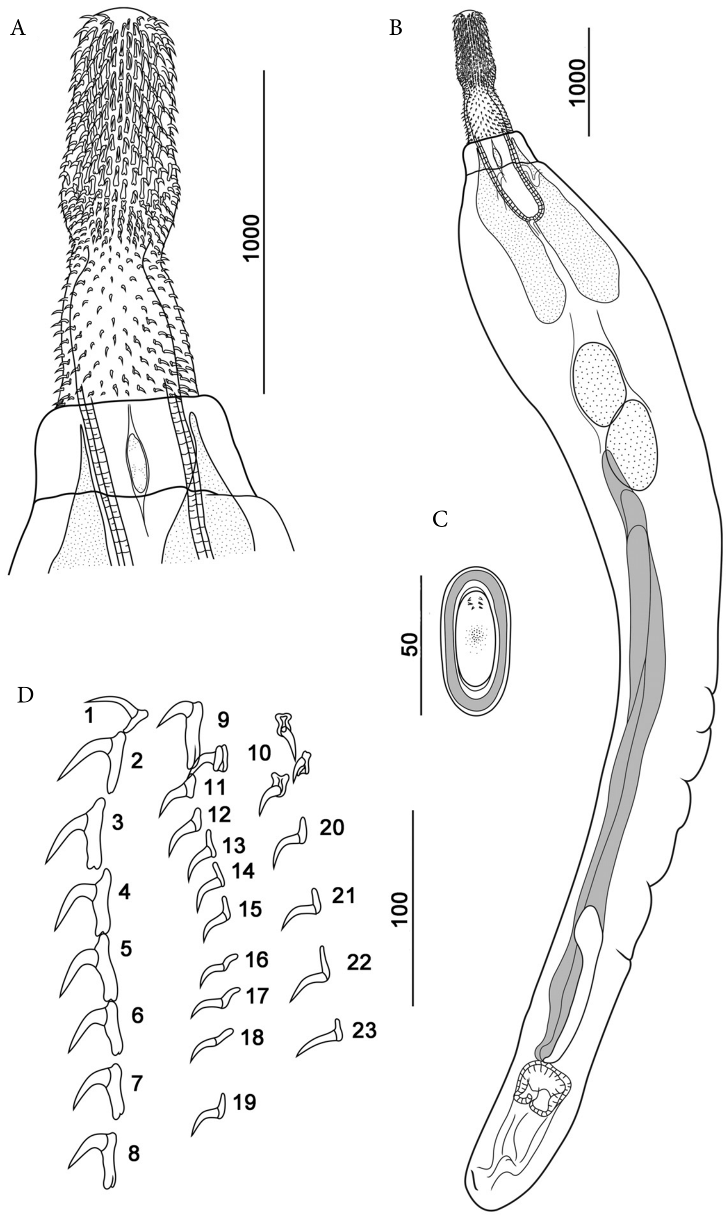


Fig. 4. *Centrorhynchus spinosus* from *Falco tinnunculus*: A — proboscis, ♂; B — hooks of a longitudinal row, ♂; C — egg; D — hooks of a longitudinal row, ♂.

Рис. 4. *Centrorhynchus spinosus* от *Falco tinnunculus*: A — хоботок, ♂; B — общий вид, ♂; C — яйцо; D — крючья продольного ряда, ♂.

970–1220 long. Cement glands 4, cylindrical. Eggs elongate-oval, without polar prolongation of fertilization membrane, 35–48 × 16–20.

The species was described from birds of prey from Japan. It is recorded from the birds of the genera *Milvus*, *Falco*, *Buteo*, *Circus*, and *Nycticorax*, *Egretta* in Russia, Pakistan, Taiwan (Schmidt, Kuntz, 1969; Khokhlova, 1986). It is found in Ukraine in western marsh harrier *Circus aeruginosus*[1], common kestrel *Falco tinnunculus*[1] in Odesa Region (Vylkove) (Zhukov, 1956).

Centrorhynchus spinosus (Kaiser, 1893) Van Cleave, 1924 fig. 4, A–E)

Syn. *Echinorhynchus spinosus* Kaiser, 1893; *Centrorhynchus spinosus* Van Cleave, 1916; *Centrorhynchus* sp.: Смогоржевская, 1954, 1964, 1976.

General (4 ♂, 3 ♀). Trunk long, narrow to anterior and posterior parts, maximal width in middle. Pro boscis with evident winding before constricrtion. Neck implict. Proboscis with 30–36 longitudinal rows of 20–23 hooks. First 8–10 hooks large with posteriorly directed strong roots. Roots 2–6 hooks with anterior processes. Largest hooks with blades and roots approximately same lengh. Next 3–5 hooks transitional, with composite scutiform processes, bifurcated in anterior part. Remainder hooks spiniform with simple root processes or without them. Proboscis receptacle double-walled, cylindrical, attach in middle proboscis. Lemnisci sacciform, longer than proboscis receptacle. Gonopore subterminal in both sexes.

Males. Trunk 15.7–16.00 mm long, with maximum width in posterior part of lemnisces 1760–2000. Proboscis 1100–1160 long with maximum width in anterior part 400, anterior part of proboscis up to level of attachment of proboscis receptacle 700–780 long with width at attachment 290–350. Proboscis with 34–36 longitudinal rows of 20–22 hooks. First 8–9 hooks large with strong roots directed posteriorly. Largest hook blade length: 1, 50–58; 2, 58–60; 3, 58; 4, 58; 5, 53–55; 6, 43–53; 7, 40–48; 8, 40–45; 9, 30–38. Hook blade thickness: 1, 7; 2, 10; 3, 6 –12; 7, 9 –15. Hook root length: 1, 32–43; 2, 50–55; 3, 53–60; 4, 50–60; 5, 48–55; 6, 50–55; 7, 50–55; 8, 55–60; 9, 37–63. Transitional hook blade length 5–38, 7–10 thick, roots 25–28 long. Remainder hook blade length 30–40, hook root processes 15–25 long. Proboscis receptacle 1160–1620 long with maximal width 400–500. Lemnisci 2400–2410 long, fall short of testes. Testes in tandem slightly overlapping one another. First testis 1030 × 610, second testis 1110 × 600. Cement glands 7.20–10.00 mm long. Säfftigen pouch 1920–2000 long.

Females. Trunk 28.00–30.00 mm long, with maximum width in posterior part of lemnisces 1700–2000. Proboscis 900–1100 long with maximum width in anterior part 350–390, anterior part of proboscis up to level of attachment of proboscis receptacle 610–720 long with width at attachment 280–330. Proboscis with 30–34 longitudinal rows of 22–23 hooks. First 9–10 hooks large with posteriorly directed strong roots. Their hook blade length: 1, 45–53; 2, 50–53; 3, 50–53; 4, 48–50; 5, 45–48; 6, 45–45; 7, 43–45; 8, 39–43; 9, 38–42; 10, 35. Hook blade thickness increasing from first hook (7) to 9th (17), and decreasing from 15 in 9–10 to 7–10 in basal hooks. Hook root length: 1, 38–48; 2, 40–50; 3, 50; 4, 50; 5, 48–53; 6, 48–53; 7, 45–53; 8, 50–55; 9, 45–53; 10, 45–53. Transitional hook blade length 35–38, roots 20–25 long. Remainder hook blade length 38–43, hook root processes 20–25 long. Proboscis receptacle 1480–1770 long. Eggs elongate-oval, without polar prolongation of fertilization membrane, 50–53 (56.1) × 25–27.

Remarks. The species was reported from glossy ibis *Plegadis falcinellus* and black-crowned night heron *Nycticorax nycticorax* in the vicinity of the Black Sea Reserve in Kherson Region (Lisitsyna, 1993, 2008). Later, a single specimen from *Nycticorax nycticorax* was assigned to *C. amphibius* (Kornyushin et al., 2004). Re-exami-nation of this specimen and its comparison with the original description of *C. amphibius* (Das, 1950) showed that the shape of the proboscis with the extension of the anterior part, the proboscis armament

(more than 30 longitudinal rows of hooks vs 26–30 in *C. amphibius*), and the number of large hooks with developed roots in longitudinal rows (9 vs 5 in *C. amphibius*) do not correspond to *C. amphibius*. At the same time, the morphology of the specimen is fully consistent with the description of *C. spinosus*.

The species was described from the birds of prey in North America. It is recorded from the birds of the genera *Strix*, *Circus*, *Elanoides*, *Herodias* in Europe, Asia and North. America. It is found in Ukraine in black-crownedon *Nycticorax nycticorax*[2], glossy ibis *Plegadis falcinellus*[2], common buzzard *Buteo buteo*[2], western marsh harrier *Circus aeruginosus*[2], common kestrel *Falco tinnunculus*[2] in Volyn Region (West Polissya), Odesa Region (Vylkove), Kyiv Region (Zazimye), Kherson Region (area Black Sea Reserve and Sofiyivka) (Khohlova, 1986[2]; Lisitsyna, 1993, 2008; Kornyushin et al., 2004).

Centrorhynchus polissiensis Lisitsyna, Greben, **sp. n.** (fig. 5, A–D)

Type host. Common buzzard *Buteo buteo* (L.) (Aves, Falconiformes, Accipitridae).

Type locality. Zazimye, Brovary District, Kiev Region, Ukraine.

Site. Intestine.

Type material. Male holotype. AH3 (SIZK); paratypes, AP. 3.1–3.6 (SIZK).

Etymology. This species is named after the bio-geographical region Polissya (forest zone).

General (4 ♂, 2 ♀). Trunk long, almost cylindrical. Proboscis division into two parts of constriction. Anterior part oval or spatulate, posterior part conical. Neck implict. Proboscis with 28–30 longitudinal rows of 19–20 hooks. First 12–13 hooks at anterior part up to constriction, remainder hooks – before constriction. First 4–6 (5) hooks large with posteriorly directed strong roots. Next 3–4 transitional with roots consisting of 2 antero-lateral alate processes, remaining hooks spiniform with anteriorly directed simple roots (fig. 5, A). Largest hook blade in 2 nd, largest hook root in 4 th. The least blades and roots in transitional hooks. Blade thickness increasing from first to 4th hooks, then gradually decreasing. The last 2–4 hooks without roots. Proboscis receptacle double-walled, attaching in middle proboscis. Lemnisci sacciform, longer than proboscis receptacle. Gonopore subterminal in both sexes.

Males. Trunk 14.14–16.69 mm long, with maximum width in anterior part 1100–1230. Proboscis 1020–1120 long, up to constriction 480–550 length with maximal width in anterior part 400–450, width in constriction 280–440. Proboscis with 28–30 longitudinal rows of 19–20 hooks. First 4–5 (5) hooks large with posteriorly directed strong roots. Hook blade length: 1, 48–65; 2, 65–70; 3, 55–65; 4, 53–63; 5, 45–55. Hook blade thickness: 1, 10–13; 2, 13–15; 3, 15–18; 4, 20–25; 5, 20–25. Hook root length: 1, 45–60; 2, 65–70; 3, 63–70; 4, 75–83; 5, 38–70. Transitional hook blade length 38–40, 10–13 thick, hook root 20–25 long. Spiniform hook blade length 40–43, hook root processes up 20. Proboscis receptacle 1300–1600 long with maximal width 300–420. Lemnisci 1220–1330 long, fall short of testes. Testes in tandem slightly diagonally or at 350–400 long. First testis 780–850 × 350–520, second testis 650–950 × 430–510. Cement glands tubulate, one longer than others, reach before posterior end of posterior testis, two others of the same length. Cement glands 8.30–9.65 mm long. Säfftigen pouch 1050–1900 long.

Females. Trunk 20.80–24.00 mm long, with maximum width in anterior part 920–1100. Proboscis 1080–1200 long with maximal width at anterior part 450–480, anterior part of proboscis up to constriction 480–530 long width at constriction 370. Proboscis with 30 longitudinal rows of 19–20 hooks. First 5–6 large with strong roots directed posteriorly. Largest hook blade length: 1, 55–63; 2, 70–73; 3, 60–68; 4, 58–63; 5, 50–55; 6, 40–45. Hook blade thickness: 1, 13; 2, 15; 3, 18; 4, 20–23; 5, 20–25; 6, 13–20. Hook root length: 1, 38–60; 2, 63–68; 3, 63–73; 4, 75–85; 5, 73–83; 6, 30–55. Transitional hook blade length 38–40, 13 thick, hook root 25–30 long. Spiniform hook blade length 40–43, hook root processes up 20. Proboscis receptacle 1460–1550 long with maximal width 300. Reproductive tract consist of vagina with two sphincters,

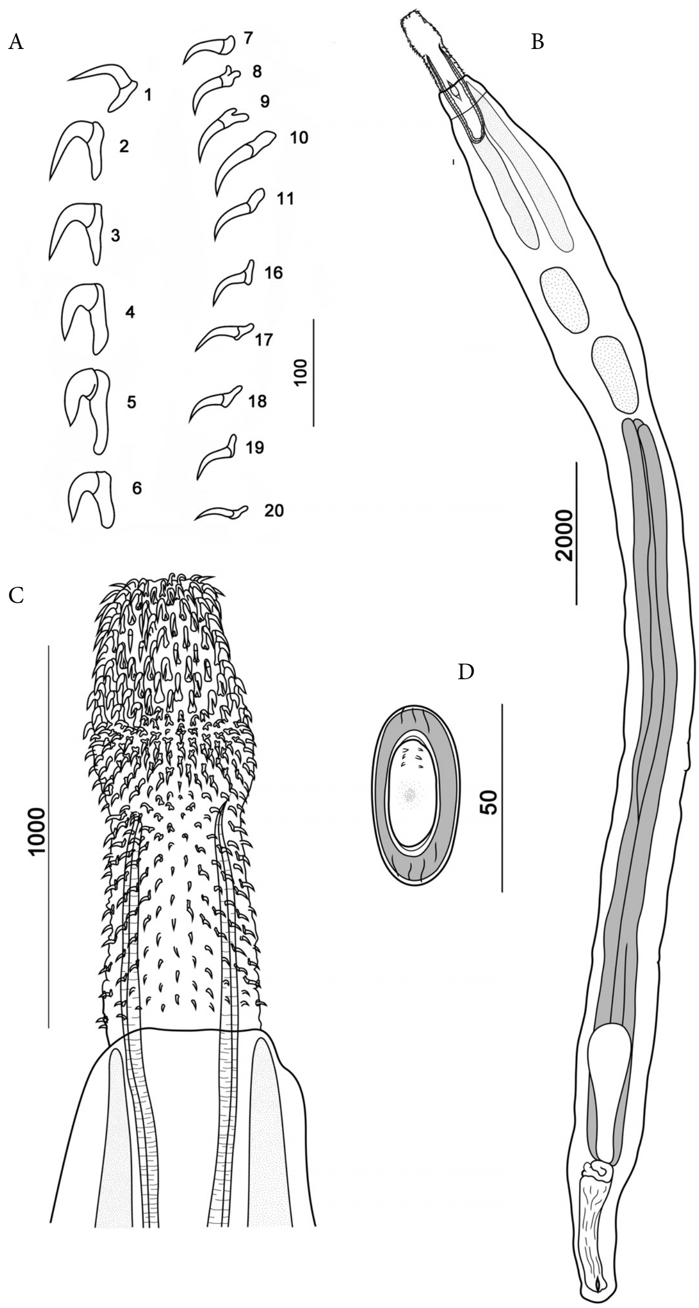


Fig. 5. *Centrorhynchus polissiensis* sp. n. from *Buteo buteo*: A — hooks of a longitudinal row, holotype, ♂; B — total view, holotype, ♂; C — proboscis, holotype, ♂; D — egg (original).

Рис. 5. *Centrorhynchus polissiensis* sp. n. от *Buteo buteo*: A — крючья продольного ряда, голотип, ♂; B — общий вид, голотип, ♂; C — хоботок, голотип, ♂; D — яйцо (оригинал).

uterus and uterine ball. Eggs elongate-oval, without polar prolongation of fertilization membrane, 45–55 × 25.

Differential diagnosis. According to the latest global review on acanthocephalans (Amin, 2013), the genus *Centrorhynchus* includes 95 species. Among them 8 species have the proboscis armament similar to that in *C. polissiensis* sp. n.: *C. albidus* Meyer, 1932 [30 × 20–22], *C. aluconis* (Muller, 1780) Lühe, 1911 [30–34 × 15–17],

C. amphibius Das, 1950 [26–30 × 20–21], *C. brama* Rengaraju, Das, 1980 [28 × 20], *C. conspectus* Van Cleave, Pratt, 1940 [26–32 × 17–19], *C. globocaudatus* (Zeder, 1800) [26–32 × 18–22], *C. guira* Lunaschi, Drago, 2010 [29–32 × 18–19], *C. javanicus* Rengaraju, Das, 1975 [28 × 19]. However, new species can not be assigned to any of them based on other characteristics. In particular, *C. albidus* has at least 7, and *C. guira* has 8–9 first hooks in each row with large blades and powerful roots (Meyer, 1932; Lunaschi, Drago, 2010) vs 4–6, more often 5 in *C. polissiensis* sp. n. In *C. javanicus* and *C. brama* the anterior part of the proboscis bears first 10 hooks of each longitudinal row (Rengaraju, Das, 1975, 1980) vs 12–13 hooks in *C. polissiensis* sp. n. The anterior part of the proboscis in *C. amphibius* is almost cylindrical, and the blade length of the largest hooks on anterior part of the proboscis is not more than 42 (Das, 1950), whereas in *C. polissiensis* sp. n. the bulb is formed on anterior part of the proboscis and the length of the blade of the second, the largest hook of *C. polissiensis* sp. n. is 65–70 in males and 70–73 in females. *C. polissiensis* sp. n. is most similar to *C. aluconis*, *C. conspectus* and *C. globocaudatus*. The transitional hooks of all four species have roots with lateral processes. The shape of the proboscis in *C. polissiensis* sp. n., *C. aluconis* and *C. conspectus* is similar, transitional hook roots of these three species have alate processes (Meyer, 1932; Petrochenko, 1958; Khohlova, 1986; Dimitrova, Gibson, 2005). However, *C. polissiensis* sp. n. has different number of hooks in a longitudinal row of the proboscis and smaller eggs. Thus, *C. aluconis* has 13–17 hooks in longitudinal row, *C. conspectus* — 17–18 hooks vs 19–20 in *C. polissiensis* sp. n. Also, both species have larger eggs: 56–65 × 28–30 in *C. aluconis*, 68–72 × 33–35 in *C. conspectus* vs 45–55 × 25 in *C. polissiensis* sp. n. *C. globocaudatus* differs from *C. polissiensis* sp. n. in shape and morphology of the proboscis hooks. Narrowing of the proboscis in *C. globocaudatus* is inconspicuous, so the proboscis is close to the conical shape, while in *C. polissiensis* sp. n. the narrowing is expressed clearly and separates the bulbous anterior and conical posterior parts of proboscis. Thickness of the blade in larger hooks of *C. globocaudatus* does not exceed 18 vs 20–25 in *C. polissiensis* sp. n. In addition, the roots of the transitional hooks of *C. globocaudatus* have alate root processes provided with lateral “X”-shaped processes vs wing-shaped root processes of transitional hooks in *C. polissiensis* sp. n.

Discussion

S. V. Ivanitzky (1940) first recorded the acanthocephalans of the genus *Centrorhynchus* in birds of the fauna of Ukraine. He investigated 3 species of the birds of prey — 15 specimens of common kestrel (*Falco tinnunculus*), 3 specimens of european honey buzzard (*Pernis apivorus*) and one pallid harrier (*Circus macrourus*) in the village Pankivka, Dnipropetrovsk Oblast. He found three species of acanthocephalans, *C. aluconis*, *C. buteonis* and Centrorhynchidae gen. sp. The author presented a list of discovered acanthocephalans indicating their hosts, prevalence, intensity, and exact localities without any comments and information on their morphology. E. V. Zhukov (1956) recorded *C. magnus* in *Circus aeruginosus* and *Falco tinnunculus* in the Danube delta. L. A. Smogorzhevska and A. Gritsenko found *C. globocaudatus* from *Falco tinnunculus* and *Circus aeruginosus*; O. I. Lisitsyna and V. V. Kornyushin et al. found *C. spinosus* from *Nycticorax nycticorax* and *Plegadis falcinellus* (Smogorzhevskaya, 1954, 1976; Gritsenko, 1969; Lisitsyna, 1993; Kornyushin et al., 2004) in the Kherson Region (close to the Black Sea Reserve territory). *C. amphibius* was reported in the south of Ukraine in *Nycticorax nycticorax*, and this finding has not been confirmed by us. *C. buteonis* and *C. magnus* have not been found after the first records in the birds of Ukraine. The materials of S. V. Ivanitzky and E. V. Zhukov has been lost, unfortunately, and we can not confirm or refute these findings. The occurrence of *C. buteonis* in the birds of Ukraine is quite possible, since this species was found in

birds of the genera *Buteo* and *Circus* in adjacent territories, in Romania and Bulgaria (Florescu, Jenistea, 1984; Bachvarov, 1988; Dimitrova et al., 2000). The occurrence of *C. magnus* is less possible, because the species was described from the birds of the genera *Milvus*, *Falco*, *Buteo* from Japan (Fukui, 1929) and later was detected in Asia (Schmidt, Kuntz, 1969), and in the European part — but to the east of the Volga River (Khohlova, 1986).

Thus, there are five species of the genus *Centrorhynchus* stored in the collection of the Department of Parasitology: *C. aluconis*, *C. conspectus*, *C. globocaudatus*, *C. spinosus* and *Centrorhynchus polissiensis* sp. n. described in this article. Totally, 7 species of the genus occur in birds of the fauna of Ukraine.

In areas adjacent to Ukraine, 7 species of acanthocephalans of the genus *Centrorhynchus* were found: *C. aluconis* in Romania and Bulgaria, *C. amphibius* in Bulgaria, *C. buteonis* in Romania and Bulgaria, *C. conspectus* in Bulgaria, *C. globocaudatus* in Hungary, Romania and Bulgaria, *C. narcissae* Florescu, 1940 in Romania, and *C. spinosus* in Bulgaria (Zacheva, 1965, 1967; Florescu, Jenistea, 1984; Petrova, 1984; Bachvarov, 1988; Dimitrova, et al., 1995, 1997, 2000). Below is the key to 9 species of the genus *Centrorhynchus* from birds of Ukraine and adjacent territories.

Key to species of the genus *Centrorhynchus* of the birds of Ukraine and adjacent territories

1a. Pear-shaped proboscis with extension in the middle part. 2
1b. Proboscis other form. 3
2a. In anterior and posterior parts of proboscis same 30–36 longitudinal hook rows. To a level of attachment of the proboscis receptacle 12–13 hooks in row. .... *C. spinosus*
2b. In anterior part of proboscis 34 longitudinal hook rows, in posterior part — 40. To a level of attachment of proboscis receptacle 9–10 hooks. .... *C. narcisae*
3a. Anterior part of proboscis almost cylindrical without evident narrowing in level of attachment of proboscis receptacle. 4
3b. Anterior part of proboscis spherical or spade-shaped with evident narrowing in the level of attachment of proboscis receptacle. 6
4a. Proboscis with 38–42 longitudinal hook rows of 26–27 hooks. .... *C. magnus*
4b. Proboscis with 26–34 longitudinal hook rows of 19–21 hooks. 5
5a. Proboscis with 26–30 longitudinal hook rows. Blade of the largest hook 42 length. .... *C. amphibius*
5b. Proboscis with 30–34 longitudinal hook rows. Blade of the largest hook 50–65 length. .... *C. globocaudatus*
6a. Each longitudinal row with 19–20 hooks. Eggs 45–55 × 25. .... *C. polissiensis* sp. n.
6b. Each longitudinal row with 13–18 hooks. Eggs 56–72 × 28–35. 7
7a. First 7–10 hooks in each longitudinal row large with strong roots. .... *C. buteonis*
7b. First 3–6 hooks in each longitudinal row large with strong roots. 8
8a. First 3–5 (usually 4) hooks in each longitudinal row large with strong roots. Eggs 56–65 × 28–30. .... *C. aluconis*
8b. First 4–6 (usually 5) hooks in each longitudinal row large with strong roots. Eggs 68–72 × 33–35. .... *C. conspectus*

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